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SEMI INVASIVE CARDIAC OUTPUT MONITORING IN A CARDIAC PATIENT UNDERGOING TOTAL THYROIDECTOMY USING SMARTPHONE APP CAPSTESIA.

Anaesthesiology

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ABSTRACT

Introduction: Advanced hemodynamic monitoring is need of today especially in patients with limited cardiac reserve. With the advent of smartphones & specially designed applications, hemodynamic monitoring becomes quite easy.

Materials & Methods: Patient was pre – medicated with Inj. Fentanyl & inj. Glycopyrrolate, induced with Inj. Etomidate & Inj. Vecuronium and maintained with mixture ofIsoflurane, Nitrous Oxide & Oxygen. An arterial line was secured in Left Radial Artery. We used the **CAPSTESIA** app to take picture of the arterial waveform using a smartphone. Demographic data of the patient was fed in the app. App used it's pre- fed algorithm to give the real time Cardiac Output, Pulse Pressure variations, Cardiac Index based upon the arterial waveform.

Results: Using the application we were able to monitor the cardiac output of the patient in real time using semi- invasive means. It enabled us to regulate the fluid management of the patient and avoid any adverse cardiac events (hypotension). With Pulse Pressure variation also available in real time, we were able to restrict use of vasopressors since the Left Ventricle Ejection Fraction of the patient was 35 % on ECHO. Surgery was conducted without any untoward event. Patient was successfully extubated and sent to PACU.

Conclusions: Advanced hemodynamic monitoring is time consuming using manual methods. We found the smartphone app **CAPSTESIA** pretty useful for semi-invasive hemodynamic monitoring of the Cardiac Output, Pulse Pressure variation, Cardiac Index,etc in real time.

KEYWORDS

Non Invasive, Cardiac Output, Pulse Pressure Variation, Cardiac Index, Smartphone, CAPSTESIA.

INTRODUCTION

- Advanced hemodynamic monitoring is need of today especially in patients with limited cardiac reserve.
- Invasive monitoring with Pulmonary Artery Catheter (PAC) was gold standard in the past with many alternatives available now.
- Semi Invasive Cardiac Output Monitoring (SICOM) include those that require cannulation of peripheral veins or arteries.
- Arterial Pulse Contour Analysis is a popular method being used in recent years for advanced hemodynamic monitoring.
- It provides Cardiac Output, Cardiac Index, Stroke Volume, Stroke Volume Variation (SVV), Pulse Pressure Variation (PPV).
- All above variables not only provide us with estimate about perfusion pressure but also give us an idea about the volume status of the patient.
- Stroke Volume is measured by the taking into account the area under the arterial pressure waveform curve with compliance and resistance of the arterial circuit along with height & weight of the patient.

- Devices that use pulse contour analysis are :
- FlocTrac Vigileo
- LiDCO
- PiCCO
- PRAM

- With the advent of smartphones & specially designed applications, hemodynamic monitoring becomes quite easy.

- We have used a smartphone app "CAPSTESIA" to take pictures of the arterial waveforms and derive requisite parameters using the pre-fed algorithm in the app itself.

- **AIM**
- **SEMI INVASIVE CARDIAC OUTPUT MONITORING IN A CARDIAC PATIENT UNDERGOING NON-CARDIAC SURGERY USING SMARTPHONE APP CAPSTESIA- A NOVAL & CONVENIENT APPROACH**

- **METHODS**
- A 58 year old male patient ASA Grade III with diagnosis of Multinodular Goitre was scheduled for Total Thyroidectomy.
- Patient had history of Coronary Artery Disease and was on Tab. Aspirin 75 mg OD.
- Laboratory investigations and ECG were within normal limit with no dyspnea or chest pain.
- ECHO findings gave35 % LVEF, Grade I Left Ventricular Diastolic Dysfunction and Left Ventricular Hypokinesia.
- Standard monitors attached and ECG, SPO2, BP & HR monitoring done.
- Patient was premedicated with Inj. Fentanyl 100 mcg & Inj. Glycopyrrolate 0.2 mg.
- He was induced with Inj. Etomidate 21 mg. Tracheal intubation was facilitated with Inj. Vecuronium 7 mg and airway was secured CETT of ID 8.0 mm.
- He was subsequently placed on ventilator and maintained with Isoflurane (0.5-1%) with oxygen (FiO2 = 0.4) and nitrous oxide.
- An arterial line was secured in Left Radial Artery and waveform was obtained on the monitor with arterial transducer.
- We used the **CAPSTESIA** app to take picture of the arterial waveform using a smartphone.
- Demographic data of the patient was fed in the app. App used it's pre- fed algorithm to give the real time Cardiac Output, Cardiac Index, Stroke Volume, Pulse Pressure variations.
- Surgery was conducted without any untoward event. Patient was successfully extubated and sent to PACU for further monitoring.

OBSERVATION/ RESULTS

- Patient was serially monitored for advanced hemodynamic parameters.

- Cardiac Output & Stroke Volume of the patient remained within acceptable range.
- It enabled us to regulate the fluid management of the patient and avoid any adverse cardiac events (hypotension).
- With Pulse Pressure variation also available in real time, we were able to restrict use of vasopressors.

DISCUSSION

- Otto Frank first suggested the concept of using the blood pressure waveform to measure blood flow changes in 1899. Frank O, 1899.
- He described the circulation in terms of "Windkessel" model. Artery is distensible, so the volumes of blood entering and leaving an arterial segment at any given moment may be different from those entering and leaving another segment at the same time.
- Volumes are same only when they are averaged over a cardiac cycle.
- SV is estimated from the systolic, the diastolic, or the systolic and diastolic components of the waveform.
- Qs/As = Qd/Ad or Qs = (Qd/Ad) × As = Qd (As/Ad)
- Rearranging these equations: SV = Qd (As/Ad) + Qd = Qd (1+ As/Ad)
- Stroke Volume = k × Pmd (1+ As/Ad)
- Parameters considered are the systolic & diastolic part of the waveform, aortic impedance & compliance and the peripheral vascular resistance.
- Cardiac Output is then calculated by multiplying Stroke Volume with Heart Rate.
- In an attempt to make fluid responsiveness evaluation more reliable, SICOM devices derived indices such as pulse pressure variation (PPV), SVV make an estimate of likely fluid responsiveness.
- However, all the above indices are inaccurate if the tidal volume and intrathoracic pressures are not constant.[1]
- Available literature regarding usefulness of SICOM devices doesn't give a clear picture about their usefulness.
- Though they appear to be safer option for monitoring with catheter related infection rate of only 0.78%.[2]

CONCLUSION

- Available literature clearly points out limitations of various Cardiac Output monitoring devices.
- More study is needed to validate the accuracy and complications associated with the Semi Invasive CO Monitoring devices.
- Nonetheless these devices provide valuable data & trend to the anaesthesiologist which further help in quick decision making.
- Advanced hemodynamic monitoring is time consuming using manual methods.
- We found the smartphone app **CAPSTESIA** useful for semi-invasive hemodynamic monitoring of the Cardiac Output, Pulse Pressure variation, Cardiac Index, etc in real time.

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